

INTERNATIONAL RECTIFIER



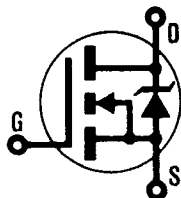
AVALANCHE AND dv/dt RATED

175°C OPERATING TEMPERATURE

HEXFET® TRANSISTORS

IRFZ34

IRFZ35



N-CHANNEL

60 Volt, 0.050 Ohm HEXFET
TO-220AB Plastic Package

The HEXFET® technology is the key to International Rectifier's advanced line of power MOSFET transistors. The efficient geometry and unique processing of this latest "State of the Art" design achieves: very low on-state resistance combined with high transconductance; superior reverse energy and diode recovery dv/dt capability.

The HEXFET transistors also feature all of the well established advantages of MOSFETs such as voltage control, very fast switching, ease of paralleling and temperature stability of the electrical parameters.

They are well suited for applications such as switching power supplies, motor controls, inverters, choppers, audio amplifiers and high energy pulse circuits.

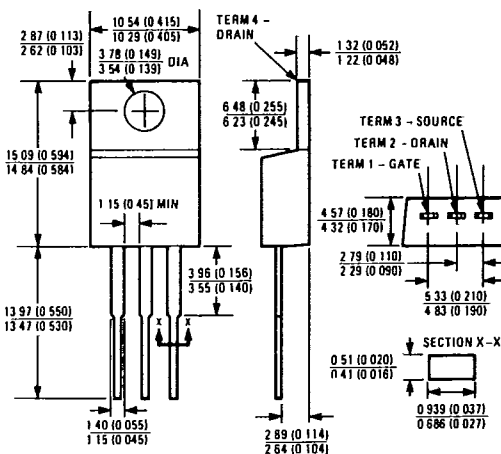
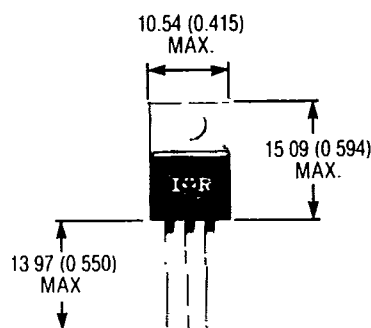
Product Summary

Part Number	BV _{DSS}	R _{DS(on)}	I _D
IRFZ34	60V	0.050Ω	30A
IRFZ35	60V	0.070Ω	25A

FEATURES

- Avalanche Rated
- Dynamic dv/dt Rating
- Simple Drive Requirements
- Ease of Paralleling

CASE STYLE AND DIMENSIONS



Case Style TO-220AB

Dimensions in Millimeters and (Inches)

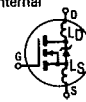
T-39-13

Absolute Maximum Ratings

Parameter	IRFZ34	IRFZ35	Units
I_D @ $T_C = 25^\circ\text{C}$ Continuous Drain Current	30	25	A
I_D @ $T_C = 100^\circ\text{C}$ Continuous Drain Current	21	18	A
I_{DM} Pulsed Drain Current ①	120	100	A
P_D @ $T_C = 25^\circ\text{C}$ Max. Power Dissipation	90		W
Linear Derating Factor	0.60		W/K ②
V_{GS} Gate-to-Source Voltage	± 20		V
E_{AS} Single Pulse Avalanche Energy ③	19 (See Fig. 14)		mJ
dv/dt Peak Diode Recovery dv/dt ③	4.5 (See Fig. 17)		V/ns
T_J Operating Junction	-55 to 175		$^\circ\text{C}$
T_{STG} Storage Temperature Range			
Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)		$^\circ\text{C}$

Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (Unless Otherwise Specified)

Parameter	Type	Min.	Typ.	Max.	Units	Test Conditions
BV_{DSS} Drain-to-Source Breakdown Voltage	IRFZ34 IRFZ35	60	—	—	V	$V_{GS} = 0V, I_D = 250 \mu A$
$R_{DS(on)}$ Static Drain-to-Source On-State Resistance ④	IRFZ34 IRFZ35	— —	0.040 0.050	0.050 0.070	Ω	$V_{GS} = 10V, I_D = 18A$
$I_{D(on)}$ On-State Drain Current ④	IRFZ34 IRFZ35	30 25	— —	— —	A	$V_{DS} > I_{D(on)} \times R_{DS(on)}$ Max. $V_{GS} = 10V$
$V_{GS(th)}$ Gate Threshold Voltage	ALL	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250 \mu A$
g_{fs} Forward Transconductance ④	ALL	9.3	14	—	S (U)	$V_{DS} \geq 50V, I_{DS} = 18A$
I_{DSS} Zero Gate Voltage Drain Current	ALL	— —	— —	250 1000	μA	$V_{DS} = \text{Max. Rating}, V_{GS} = 0V$ $V_{DS} = 0.8 \times \text{Max. Rating}$ $V_{GS} = 0V, T_J = 150^\circ\text{C}$
I_{GSS} Gate-to-Source Leakage Forward	ALL	—	—	500	nA	$V_{GS} = 20V$
I_{GSS} Gate-to-Source Leakage Reverse	ALL	—	—	-500	nA	$V_{GS} = -20V$
Q_g Total Gate Charge	ALL	—	32	47	nC	$V_{GS} = 10V, I_D = 30A$ $V_{DS} = 0.8 \times \text{Max. Rating}$ See Fig. 16 (Independent of operating temperature)
Q_{gs} Gate-to-Source Charge	ALL	—	6.8	10	nC	
Q_{gd} Gate-to-Drain ("Miller") Charge	ALL	—	15	22	nC	
$t_{d(on)}$ Turn-On Delay Time	ALL	—	14	21	ns	$V_{DD} = 30V, I_D = 30A, R_G = 12\Omega$
t_r Rise Time	ALL	—	71	110	ns	$R_D = 1.0\Omega$
$t_{d(off)}$ Turn-Off Delay Time	ALL	—	35	53	ns	See Fig. 15
t_f Fall Time	ALL	—	53	80	ns	(Independent of operating temperature)
L_D Internal Drain Inductance	ALL	—	4.5	—	nH	Measured from the drain lead, 6mm (0.25 in.) from package to center of die
L_S Internal Source Inductance	ALL	—	7.5	—	nH	Measured from the source lead, 6mm (0.25 in.) from package to source bonding pad
C_{iss} Input Capacitance	ALL	—	1300	—	pF	$V_{GS} = 0V, V_{DS} = 25V$
C_{oss} Output Capacitance	ALL	—	650	—	pF	$f = 1.0 \text{ MHz}$
C_{rss} Reverse Transfer Capacitance	ALL	—	100	—	pF	See Fig. 10



Source-Drain Diode Ratings and Characteristics

Parameter		Type	Min.	Typ.	Max.	Units	Test Conditions
I_S	Continuous Source Current (Body Diode)	ALL	—	—	30	A	Modified MOSFET symbol showing the integral Reverse p-n junction rectifier 
I_{SM}	Pulsed Source Current (Body Diode) ①	ALL	—	—	120	A	
V_{SD}	Diode Forward Voltage ④	ALL	—	—	1.6	V	$T_J = 25^{\circ}\text{C}$, $I_S = 30\text{A}$, $V_{GS} = 0\text{V}$
t_{rr}	Reverse Recovery Time	ALL	50	100	220	ns	$T_J = 25^{\circ}\text{C}$, $I_F = 30\text{A}$, $dI/dt = 100\text{ A}/\mu\text{s}$
Q_{RR}	Reverse Recovery Charge	ALL	1.9	4.2	9.6	μC	
t_{on}	Forward Turn-On Time	ALL	Intrinsic turn-on time is negligible. Turn-on speed is substantially controlled by $L_S + L_D$				

Thermal Resistance

R_{thJC} Junction-to-Case	ALL	—	—	1.7	K/W ⑤	
R_{thCS} Case-to-Sink	ALL	—	0.50	—	K/W ⑤	Mounting surface flat, smooth, and greased
R_{thJA} Junction-to-Ambient	ALL	—	—	80	K/W ⑤	Typical socket mount

① Repetitive Rating; Pulse width limited by maximum junction temperature (see figure 5)
Refer to current HEXFET reliability report

② @ $V_{DD} = 25\text{V}$, Starting $T_J = 25^\circ\text{C}$,
 $L = 50\mu\text{H}$, $R_G = 25\Omega$,
Peak $I_L = 21\text{A}$

③ $I_{SD} \leq 21\text{A}$ $dI/dt \leq 200\text{ A}/\mu\text{s}$,
 $V_{DD} \leq BV_{DSS}$, $T_J \leq 175^\circ\text{C}$
Suggested $R_G = 12\Omega$

④ Pulse width $\leq 300\mu\text{s}$; Duty Cycle $\leq 2\%$

⑤ $\text{K/W} = ^\circ\text{C/W}$
 $\text{W/K} = \text{W}/^\circ\text{C}$

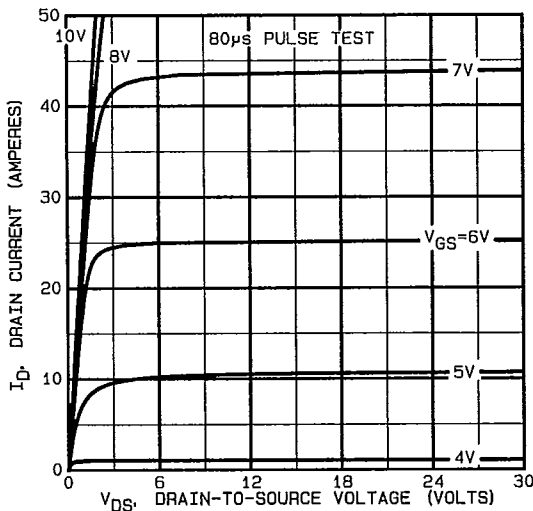


Fig. 1 — Typical Output Characteristics

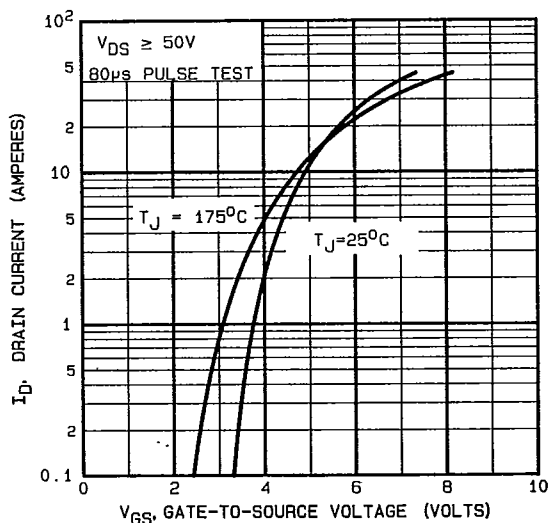
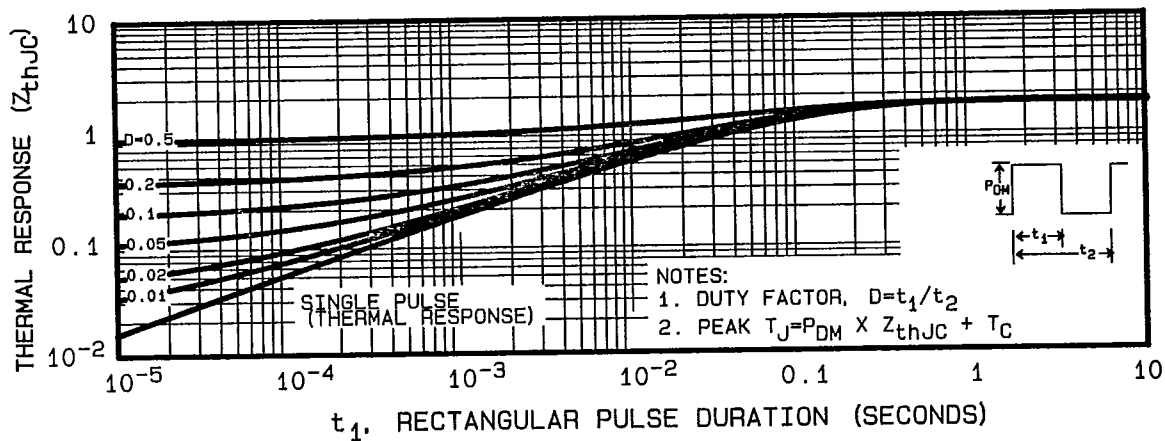
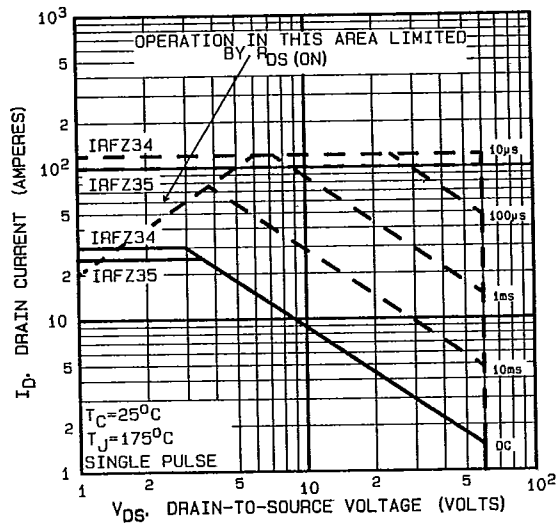
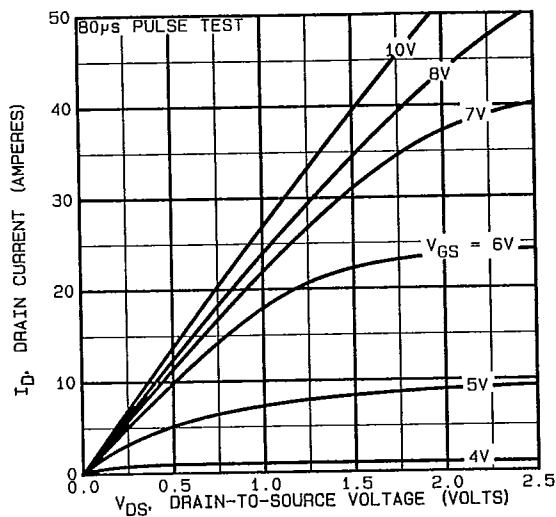


Fig. 2 — Typical Transfer Characteristics



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IRFZ34, IRFZ35 Devices

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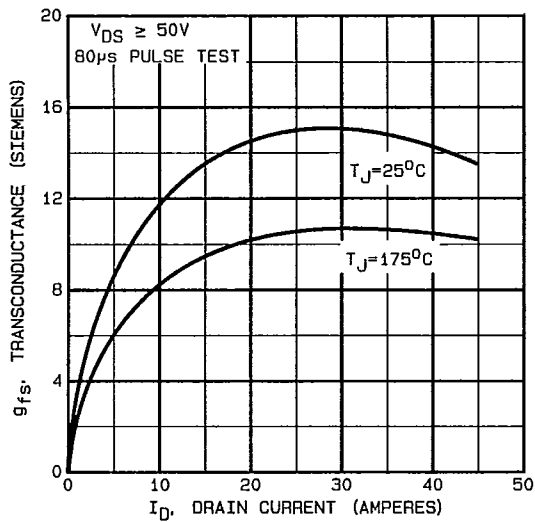


Fig. 6 — Typical Transconductance Vs. Drain Current

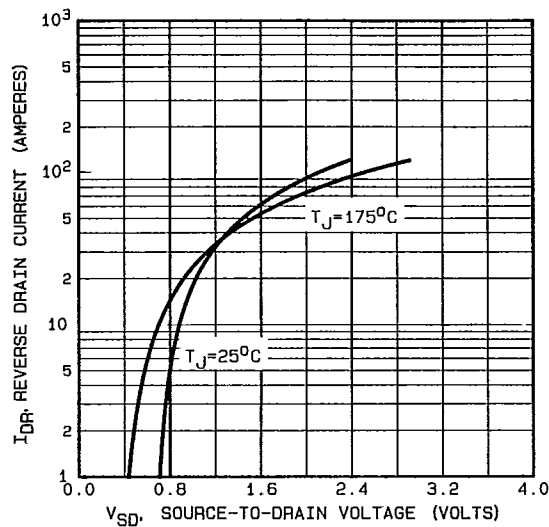


Fig. 7 — Typical Source-Drain Diode Forward Voltage

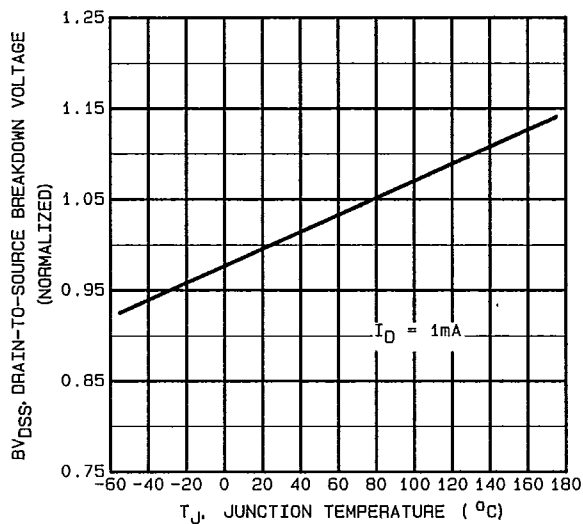


Fig. 8 — Breakdown Voltage Vs. Temperature

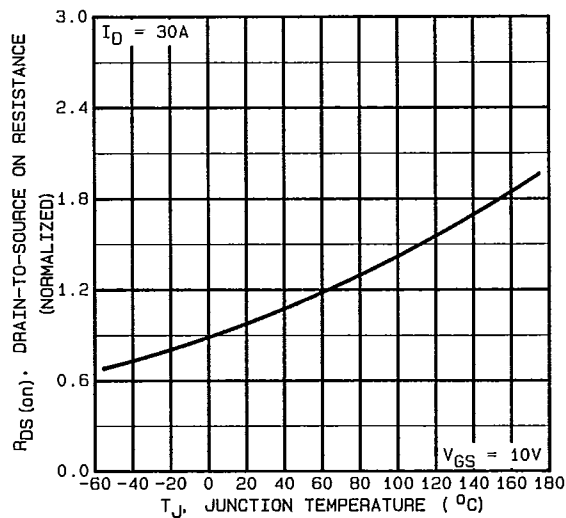


Fig. 9 — Normalized On-Resistance Vs. Temperature

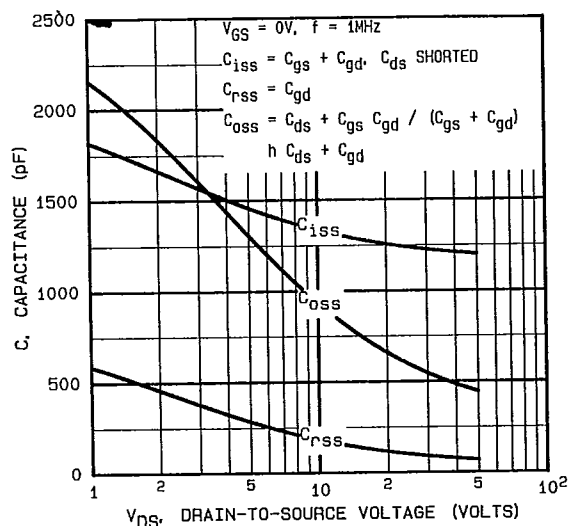


Fig. 10 — Typical Capacitance Vs. Drain-to-Source Voltage

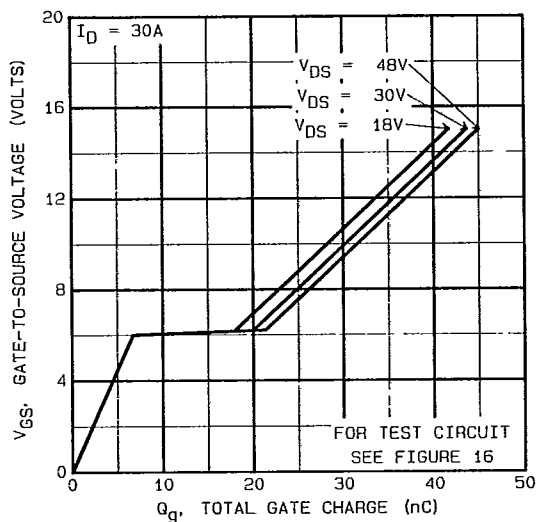


Fig. 11 — Typical Gate Charge Vs. Gate-to-Source Voltage

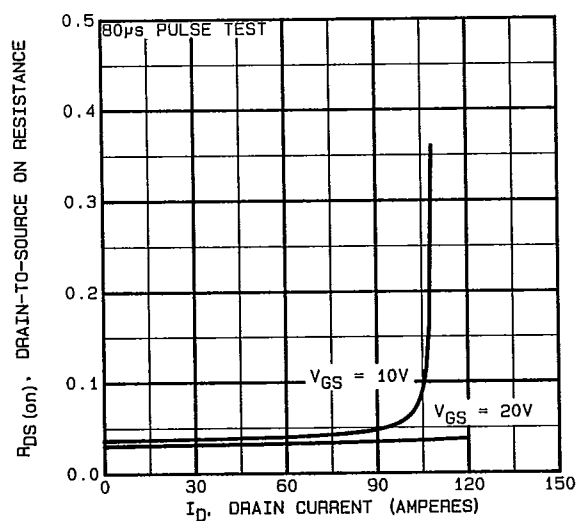


Fig. 12 — Typical On-Resistance Vs. Drain Current

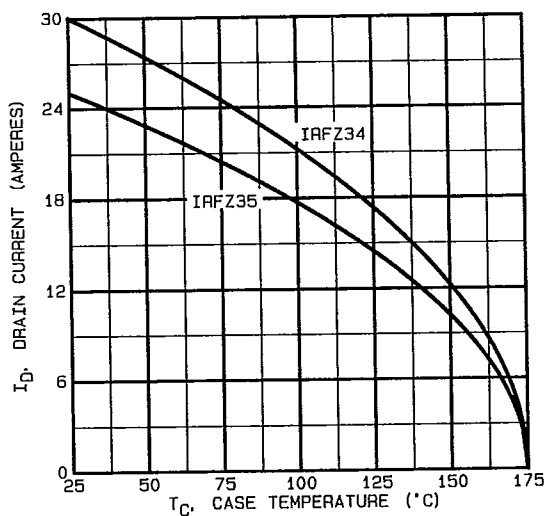


Fig. 13 — Maximum Drain Current Vs. Case Temperature

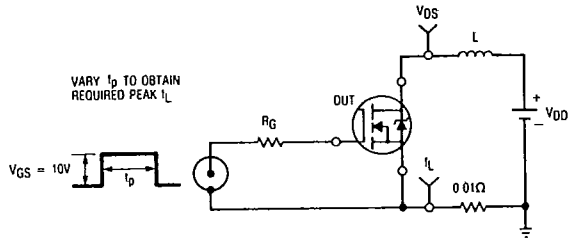


Fig. 14a — Unclamped Inductive Test Circuit

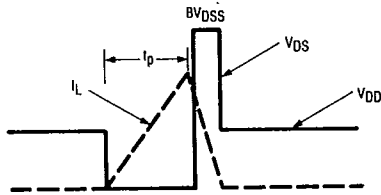


Fig. 14b — Unclamped Inductive Waveforms

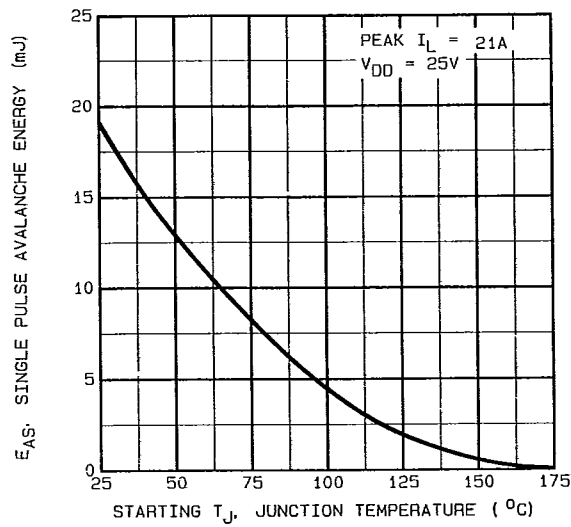


Fig. 14c — Maximum Avalanche Energy Vs. Starting Junction Temperature

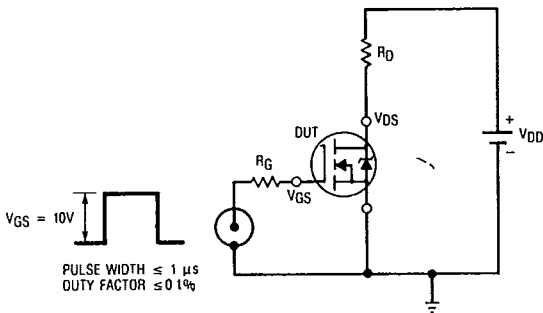


Fig. 15a — Switching Time Test Circuit

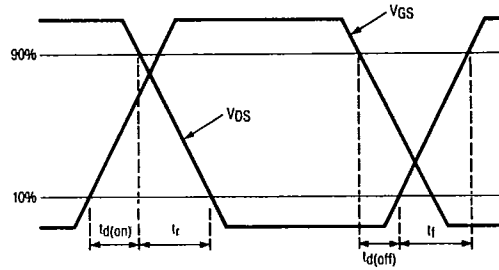


Fig. 15b — Switching Time Waveforms

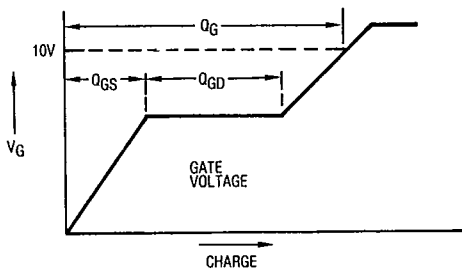


Fig. 16a — Basic Gate Charge Waveform

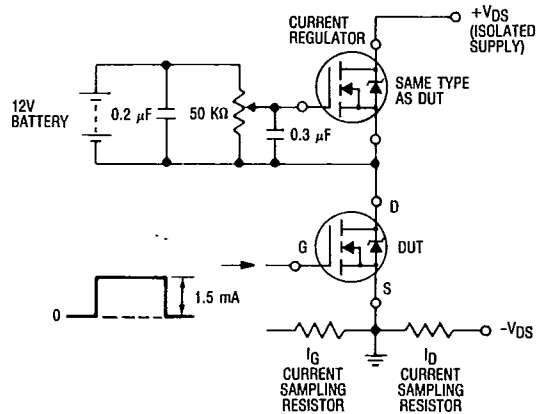


Fig. 16b — Gate Charge Test Circuit

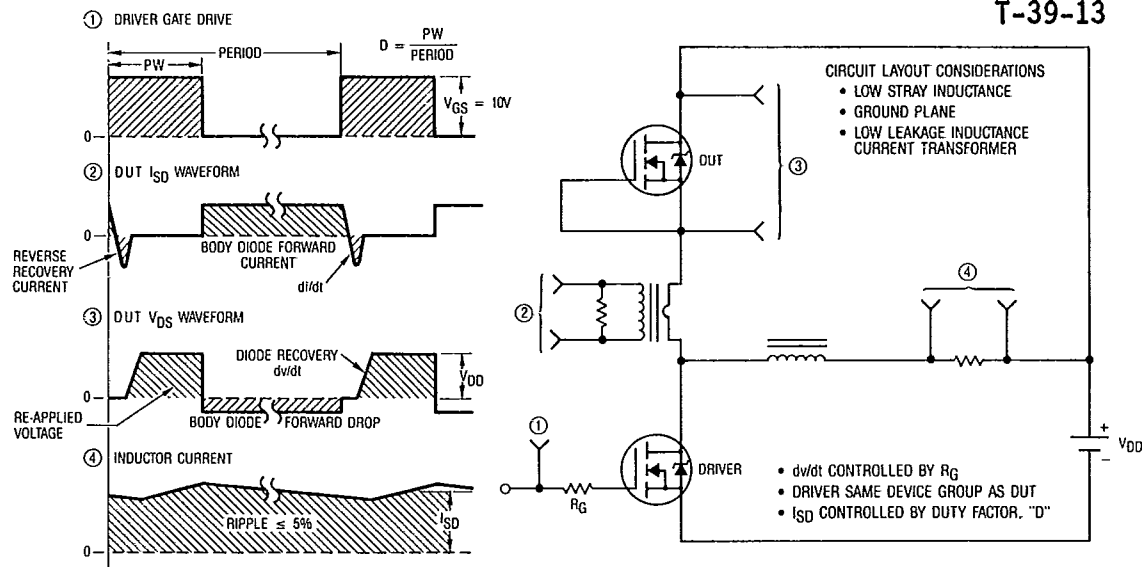
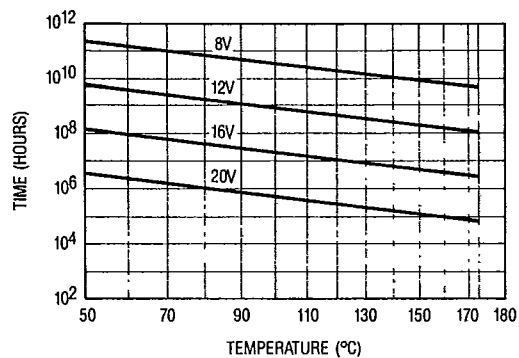
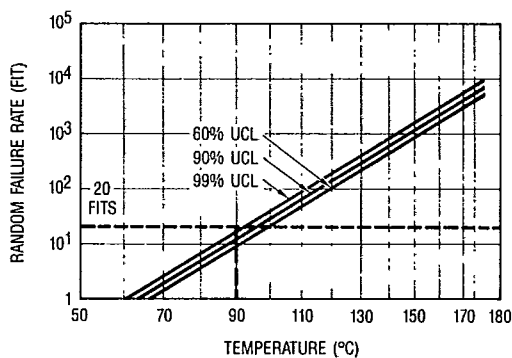


Fig. 17 — Peak Diode Recovery dv/dt Test Circuit



*Fig. 18 — Typical Time to Accumulated 1% Gate Failure



*Fig. 19 — Typical High Temperature Reverse Bias (HTRB) Failure Rate

*The data shown is correct as of January 15, 1987. This information is updated on a quarterly basis; for the latest reliability data, please contact your local IR field office.